

This Page Is Inserted by IFW Operations
and is not a part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,
please do not report the images to the
Image Problem Mailbox.**

Examiner's Copy

431

AN 1999:681605 HCAPLUS
DN 131:302273
TI Manufacture of copper alloy thin wire having high strength and
fatigue resistance
IN Fujiwara, Hidemichi; Yamazaki, Akira; Osada, Katsuki
PA Furukawa Electric Co., Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 7 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 11293431	A2	19991026	JP 1998-99784	19980413
AB	Cu alloy thin wire having diam. $\leq 50 \mu\text{m}$ is from Cu-(1.0-4.5%)Ag alloy, Cu-(0.2-1.5%)Cr alloy, Cu-(0.1-0.3%)Zr alloy, Cu-(0.2-1.5%)Cr-(0.1-0.3%)Zr alloy or Cu-(0.3-4.0%)Ti alloy by cold drawing at $\leq 99.999\%$ draft optionally with intermediate annealing. When intermediate annealing is carried out, the cold draft between intermediate annealing processes is $\leq 99.999\%$ and the cold draft after the final annealing is 80-99%.				

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平11-293431

(43) 公開日 平成11年(1999)10月26日

(51) Int.Cl. ⁶	識別記号	F I
C 2 2 F 1/08		C 2 2 F 1/08 C
B 2 1 C 1/00		B 2 1 C 1/00 B
C 2 2 C 9/00		C 2 2 C 9/00
H 0 1 B 1/02		H 0 1 B 1/02 A
// C 2 2 F 1/00	6 2 5	C 2 2 F 1/00 6 2 5
審査請求 未請求 請求項の数 3 O L (全 7 頁) 最終頁に続く		

(21) 出願番号 特願平10-99784

(22) 出願日 平成10年(1998)4月13日

(71) 出願人 000005290

古河電気工業株式会社

東京都千代田区丸の内2丁目6番1号

(72) 発明者 藤原 英道

東京都千代田区丸の内2丁目6番1号 古

河電気工業株式会社内

(72) 発明者 山崎 明

東京都千代田区丸の内2丁目6番1号 古

河電気工業株式会社内

(72) 発明者 長田 克己

東京都千代田区丸の内2丁目6番1号 古

河電気工業株式会社内

(54) 【発明の名称】 銅合金極細線の製造方法

(57) 【要約】

【課題】 伸線性、強度、耐疲労特性などに優れる線径が50 μ m以下の銅合金極細線の製造方法を提供する。

【解決手段】 晶出物などの異相を含む銅合金軟質素材(Cu-1.0~4.5wt%Ag合金、Cu-0.2~1.5wt%Cr合金、Cu-0.1~0.3wt%Zr合金、Cu-0.2~1.5wt%Cr-0.1~0.3wt%Zr合金、またはCu-0.3~4.0wt%Ti合金など)を冷間加工し、必要に応じて中間焼鈍を施す、線径50 μ m以下の銅合金極細線の製造方法であって、前記銅合金軟質素材からの冷間加工率を99.999%以下にし、最終中間焼鈍以外の中間焼鈍後の次の中間焼鈍までの冷間加工率を99.999%以下にし、最終中間焼鈍後の冷間加工率を80~99%にする。

【特許請求の範囲】

【請求項 1】 晶出物などの異相を含む銅合金軟質素材を冷間加工し、必要に応じて中間焼鈍を施す、線径 50 μm 以下の銅合金極細線の製造方法であって、前記銅合金軟質素材からの冷間加工率を 99.999% 以下とし、中間焼鈍を施す場合は、中間焼鈍と中間焼鈍の間の冷間加工率は 99.999% 以下とし、最終中間焼鈍後の冷間加工率は 80~99% にすることを特徴とする銅合金極細線の製造方法。

【請求項 2】 晶出物などの異相を含む銅合金軟質素材が Cu-1.0~4.5wt% Ag 合金、Cu-0.2~1.5wt% Cr 合金、Cu-0.1~0.3wt% Zr 合金、Cu-0.2~1.5wt% Cr-0.1~0.3wt% Zr 合金、または Cu-0.3~4.0wt% Ti 合金であることを特徴とする請求項 1 記載の銅合金極細線の製造方法。

【請求項 3】 中間焼鈍を 300~550℃ で 1 秒~30 分間保持して施すことを特徴とする請求項 1 または 2 記載の銅合金極細線の製造方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、伸線性、強度、耐疲労特性などに優れ、特に巻線に適した線径 50 μm 以下の銅合金極細線の製造方法に関する。

【0002】

【従来の技術】 巻線などに使用される銅合金極細線には、伸線性、強度、耐疲労特性などが要求される。特に、伸線性はコストに大きく影響するので重要である。このような銅合金極細線には、従来より、タフピッチ銅、Sn 入り銅合金、0.2% 以下の Ag を含む銅合金などが用いられてきた。そして、近年の携帯機器の小型化に伴って、巻線用極細線には 50 μm 以下、さらには 30 μm から 20 μm へと細線化が求められ、また強度や耐疲労特性なども以前より重視されるようになってきている。

【0003】

【発明が解決しようとする課題】 しかし、従来の銅合金極細線は 50 μm 以下の径になると断線し易くなり生産性に問題が生じている。そこで、本発明者等は、冷間加工性に優れる銅合金を種々探索し、Ag を 1% 以上含有する銅合金や Cu-Cr 合金などは加工条件を選定することにより 20 μm 以下の径に細線化できることを見だし、さらに研究を進めて本発明を完成させるに至った。本発明の目的は、伸線性、強度、耐疲労特性などに優れる線径が 50 μm 以下の銅合金極細線の製造方法を提供することにある。

【0004】

【課題を解決するための手段】 請求項 1 記載の発明は、晶出物などの異相を含む銅合金軟質素材を冷間加工し、必要に応じて中間焼鈍を施す、線径 50 μm 以下の銅

合金極細線の製造方法であって、前記銅合金軟質素材からの冷間加工率を 99.999% 以下とし、中間焼鈍を施す場合は、中間焼鈍と中間焼鈍の間の冷間加工率は 99.999% 以下とし、最終中間焼鈍後の冷間加工率は 80~99% にすることを特徴とする銅合金極細線の製造方法である。

【0005】 請求項 2 記載の発明は、晶出物などの異相を含む銅合金軟質素材が Cu-1.0~4.5wt% Ag 合金、Cu-0.2~1.5wt% Cr 合金、Cu-0.1~0.3wt% Zr 合金、Cu-0.2~1.5wt% Cr-0.1~0.3wt% Zr 合金、または Cu-0.3~4.0wt% Ti 合金であることを特徴とする請求項 1 記載の銅合金極細線の製造方法である。

【0006】 請求項 3 記載の発明は、中間焼鈍を 300~550℃ で 1 秒~30 分間保持して施すことを特徴とする請求項 1 または 2 記載の銅合金極細線の製造方法である。

【0007】

【発明の実施の形態】 本発明は、晶出物などの異相を含む銅合金軟質素材を、必要に応じて中間焼鈍を施しつつ、所定の加工率で冷間加工して、線径 50 μm 以下の極細線に加工する方法である。前記晶出物などの異相には析出物なども含まれる。銅合金軟質素材としては、Cu-1.0~4.5wt% Ag 合金、Cu-0.2~1.5wt% Cr 合金、Cu-0.1~0.3wt% Zr 合金、Cu-0.2~1.5wt% Cr-0.1~0.3wt% Zr 合金、または Cu-0.3~4.0wt% Ti 合金などの小径鋳塊、熱間圧延材（荒引線）、熱間押出材、焼鈍材などが挙げられる。前記銅合金軟質素材は、圧延、溝ロール圧延、引拔加工、伸線加工などにより冷間で加工されて所望形状の極細線に加工される。

【0008】 前記各銅合金には、合金元素の晶出物などの異相（Ag 粒子、Cr 粒子、Zr-Cu 化合物粒子、Ti-Cu 化合物粒子など）がそれぞれ冷間加工により短繊維状に微細に分散しており、これら分散物は、冷間加工に伴って銅合金マトリックスに形成される転位セルを微細かつ均一に分布させる作用を果たし、前記各銅合金の冷間加工性を向上させる。前記各銅合金の合金元素量の規定理由は、いずれも、下限未満では前記晶出物などが少ないため転位セルが微細かつ均一に分布せず、上限を超えると晶出物などが著しく粗大化して断線を惹起するためである。

【0009】 前記晶出物は、前述のように、転位セルを微細かつ均一化するが、反面、冷間加工が進むと転位セルが著しく微細化し、そこに転位がピン止めされて断線が起き易くなる。

【0010】 そこで、本発明では、前記銅合金軟質素材からの冷間加工率が 99.999% を超える場合は、中間焼鈍を施して断線を防止する。中間焼鈍により、転位が熱活性的に移動して転位セルが粗大化して冷間加工性

が改善される。中間焼鈍を複数回施す場合の中間焼鈍間の冷間加工率は、前記銅合金軟質素材からの冷間加工率と同じように99.999%以下にする。但し、最終中間焼鈍後の冷間加工率は80~99%に規定する。その理由は、80%未満では銅合金極細線に必要な強度が得られず、99%を超えると転位セルが微細化してコイルリングなどの際に断線し易くなるためである。なお、Cu-Cr合金、Cu-Zr合金、Cu-Ti合金は、冷間加工後、時効処理を施すことによりさらに強度を向上させることができる。

【0011】前述のように、転位セルが微細に形成された冷間加工線材を中間焼鈍すると、転位が熱活性的に移動して転位セルが粗大化して冷間加工性が改善される。前記中間焼鈍は、焼鈍温度が300℃未満ではその効果が十分に得られず、550℃を超えると焼鈍による強度低下が大きく、以後、冷間加工しても十分な強度が得られなくなる。また焼鈍時間が1秒未満では転位が熱活性的に移動するための時間が不足し、また30分を超えると中間焼鈍の効果が飽和してエネルギーコスト的に不利になる。従って中間焼鈍は300~550℃で1秒~30分間施すのが望ましい。

【0012】

【実施例】以下に本発明を実施例により詳細に説明する。

（実施例1）本発明規定内組成の種々の銅合金を横型連続鑄造機により10.8mm径の棒状鑄塊に鑄造し、この鑄塊を10mm径に皮むきし、この皮むき後の鑄塊を伸線加工して0.10mm径または0.05mm径の線材とした。次いで前記各線材に300~550℃で30秒間保持する条件で走間焼鈍を施し、その後再び伸線加工して20μm（0.02mm）径の銅合金極細線を製造した。

【0013】（実施例2）本発明規定内組成の種々の銅合金を横型連続鑄造機により10.8mm径の棒状鑄塊に鑄造し、この鑄塊を10mm径に皮むきし、この皮む

き後の鑄塊を伸線加工して0.10mm径または0.05mm径の線材とした。次いで前記各線材に580℃または280℃で30秒間保持する条件で走間焼鈍を施し、その後再び伸線加工して20μm径の銅合金極細線を製造した。

【0014】（比較例1）本発明規定内組成の種々の銅合金を横型連続鑄造機により10.8mm径の棒状鑄塊に鑄造し、この鑄塊を10mm径に皮むきし、この皮むき後の鑄塊を伸線加工して0.30mm径または0.03mm径の線材とした。次いで前記各線材に400℃で30秒間保持する条件で走間焼鈍を施し、その後再び伸線加工して20μm径の銅合金極細線を製造した。

【0015】（比較例2）本発明規定内組成の種々の銅合金を横型連続鑄造機により10.8mm径の棒状鑄塊に鑄造し、この鑄塊を10mm径に皮むきし、この皮むき後の鑄塊を伸線加工して20μm径の銅合金極細線を製造した。途中走間焼鈍は施さなかった。

【0016】（比較例3）本発明規定外組成の銅合金を横型連続鑄造機により10.8mm径の棒状鑄塊に鑄造し、この鑄塊を10mm径に皮むきし、この皮むき後の鑄塊を伸線加工して0.10mm径または0.05mm径の線材とした。次いで前記各線材に400℃で30秒保持する条件で走間焼鈍を施し、その後再び伸線加工して20μm径の銅合金極細線を製造した。

【0017】実施例1、2、比較例1~3で得られた各々の銅合金極細線について、引張強さ、疲労破断特性、伸線性を調査した。疲労破断特性は200N/mm²の応力を負荷しつつ90度曲げを繰返したときの破断までの回数で表した。1往復を1回と数えた。伸線性は30μmから20μmに連続伸線したときの破断回数で伸線量を除した値で表した。合金組成の分析値を表1に、調査結果を表2~5にそれぞれ示す。表2~5には伸線条件および焼鈍条件を併記した。

【0018】

【表1】

	合金	Ag	Cr	Zr	Ti		合金	Ag	Cr	Zr	Ti
本発明規定内組成合金	1	1.0	---	---	---	本発明規定外組成合金	10	0.2	---	---	---
	2	2.0	---	---	---		11	---	0.15	---	---
	3	4.0	---	---	---		12	---	---	0.05	---
	4	---	0.3	---	---		13	---	0.04	0.03	---
	5	---	1.3	---	---		14	---	---	---	0.1
	6	---	---	0.25	---						
	7	---	0.28	0.22	---						
	8	---	---	---	0.5						
	9	---	---	---	3.8						

(注) 単位wt%。

【0019】

【表2】

分類	試料	合金	焼鈍サイズ # mm	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1断線
本発明例	1	1	0.1	400	840	17	3.9
	2		0.05	400	800	10	4.1
	3	2	0.1	550	880	23	3.5
	4		0.1	400	950	40	3.8
	5		0.1	300	970	42	3.6
	6		0.05	400	900	35	4.2
	7	3	0.1	400	1010	45	3.6
	8		0.05	400	960	41	3.4
	9	4	0.1	400	890	24	3.5
	10		0.05	400	850	18	4.0
	11	5	0.1	400	960	41	3.5
	12		0.05	400	920	37	3.7

(注) #10mm径-(99.99%)→0.1mm径-(96%)→0.02mm径
 10mm径-(99.9975%)→0.05mm径-(84%)→0.02mm径
 試料No.1~12は実施例1。

【0020】

【表3】

分類	試料	合金	焼鈍線径 # mm	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1断線
本 発 明 例	13	6	0.1	400	850	15	3.8
	14		0.05	400	800	10	4.1
	15	7	0.1	400	940	35	3.5
	16		0.05	400	900	28	3.8
	17	8	0.1	400	1100	50	3.1
	18		0.05	400	1050	44	3.3
	19	9	0.1	400	1210	57	3.0
	20		0.05	400	1140	53	3.1
	21	2	0.1	570	840	14	3.7
	22		0.1	280	990	43	3.4
	23	3	0.1	570	910	29	3.6
	24		0.1	280	1060	45	3.3

(注) #10mm径—(99.99%)→0.1mm径(96%)→0.02mm径
 10mm径—(99.9975%)→0.05mm径(84%)→0.02mm径
 試料No.13~20は実施例1、試料No.21~24は実施例2。

【0021】

【表4】

分類	試料	合金	焼鈍線径 # mm	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1断線
比 較 例 1	25	2	0.3	400	980	33	1.3
	26		0.03	400	720	2.1	2.8
	27	3	0.3	400	1010	38	1.5
	28		0.03	400	760	3.3	2.6
	29	4	0.3	400	910	18	1.1
	30		0.03	400	680	1.1	2.2
	31	6	0.3	400	870	15	0.8
	32		0.03	400	620	0.9	1.4
	33	7	0.3	400	960	28	0.7
	34		0.03	400	730	1.8	1.6
	35	8	0.3	400	1070	39	1.9
	36		0.03	400	790	3.8	2.7

(注) #10mm径—(99.91%)→0.3mm径—(99.56%)→0.02mm径
 10mm径—(99.9991%)→0.03mm径—(55.56%)→0.02mm径

【0022】

【表5】

分類	試料	合金	焼鈍サイズ # mm 径	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1断線
比較例 2	37	2	中間焼鈍なし		1050	34	0.34
	38	3	"		1060	36	0.41
	39	4	"		820	16	0.22
	40	6	"		820	14	0.32
	41	7	"		840	18	0.50
	42	8	"		1010	33	0.37
比較例 3	43	10	0.1	400	920	19	0.33
	44		0.05	400	870	14	0.52
	45	11	0.1	400	650	1.0	2.83
	46		0.05	400	620	0.8	2.52
	47	12	0.1	400	720	3.5	1.4
	48		0.05	400	620	1.1	1.6
	49	13	0.1	400	810	9.5	1.7
	50		0.05	400	780	3.3	1.2
	51	14	0.1	400	950	18	0.52
	52		0.05	400	920	21	0.44

(注) #10mm径(99.9996%)→0.02mm径(中間焼鈍なし)

10mm径(99.99%)→0.1mm径(96%)→0.02mm径

10mm径(99.9975%)→0.05mm径(84%)→0.02mm径

【0023】表2～5より明らかなように、本発明例の試料No.1～24は、いずれも、1断線あたり3.0kg以上の伸線性を有しているうえ、強度、耐疲労特性にも優れている(引張強さ800N/mm²以上、疲労破断回数が10⁷回以上)。これに対し、比較例1のNo.25～36と比較例2のNo.37～42は冷間加工率が本発明の規定を外れたため、比較例3のNo.43～52は合金元素量が少ないため、いずれも伸線性が低下して実用に適さないものであった。また最終中間焼鈍後の冷間加工率が99%を超えたもの(No.25, 27, 29, 31, 33, 35)は、腰が弱くコイルリング性(表示せず)に劣り、前記冷間加工率が80%未満のもの(No.26, 28, 30, 32, 34, 36)は引張強さと疲労破断特性に劣った。合金元素量が不足したもののうちNo.4

5～50は引張強さと疲労破断特性の少なくとも1種が劣った。

【0024】

【発明の効果】以上に述べたように、本発明で用いる銅合金は、そこに含まれる晶出物などが転位セルを微細かつ均一に分布させるので冷間加工性に優れ、しかも本発明では前記銅合金を所定条件で、必要に応じて焼鈍を入れながら冷間加工するので、50μm以下の極細線を良好に製造することができる。さらに本発明にて得られる極細線は強度および耐疲労特性にも優れる。依って、本発明は、巻線などの製造に適用して顕著な効果を奏する。

フロントページの続き

(51) Int. Cl.⁶

C 2 2 F 1/00

識別記号

6 3 0

F I

C 2 2 F 1/00

6 3 0 A

6 3 0 G

6 3 0 K

6 8 5 Z

6 8 6 Z

6 9 1 C

6 9 1 B

6 9 4 A

6 8 5

6 8 6

6 9 1

6 9 4

Examiner's Copy

AN 1999:681605 HCAPLUS
DN 131:302273
TI Manufacture of copper alloy thin wire having high strength and
fatigue resistance
IN Fujiwara, Hidemichi; Yamazaki, Akira; Osada, Katsuki
PA Furukawa Electric Co., Ltd., Japan
SO Jpn. Kokai Tokkyo Koho, 7 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 11293431	A2	19991026	JP 1998-99784	19980413
AB	Cu alloy thin wire having diam. .ltoreq.50 .mu.m is from Cu-(1.0-4.5%)Ag alloy, Cu-(0.2-1.5%)Cr alloy, Cu-(0.1-0.3%)Zr alloy, Cu-(0.2-1.5)Cr-(0.1-0.3%)Zr alloy or Cu-(0.3-4.0%)Ti alloy by cold drawing at .ltoreq.99.999% draft optionally with intermediate annealing. When intermediate annealing is carried out, the cold draft between intermediate annealing processes is .ltoreq.99.999% and the cold draft after the final annealing is 80-99%.				

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-293431

(43)Date of publication of application : 26.10.1999

Int.Cl. C22F 1/08
B21C 1/00
C22C 9/00
H01B 1/02
// C22F 1/00
C22F 1/00
C22F 1/00
C22F 1/00
C22F 1/00
C22F 1/00

Application number : 10-099784

(71)Applicant : FURUKAWA ELECTRIC CO LTD:THE

Date of filing : 13.04.1998

(72)Inventor : FUJIWARA HIDEMICHI

YAMAZAKI AKIRA

OSADA KATSUMI

PRODUCTION OF COPPER ALLOY EXTRA FINE WIRE

Abstract:

PROBLEM TO BE SOLVED: To provide a method for producing a copper alloy extra fine wire of $\leq 50 \mu\text{m}$ in diameter excellent in wire drawability, strength, fatigue resistance.

SOLUTION: This is a method for producing a copper alloy extra fine thin wire of $\leq 50 \mu\text{m}$ in wire diameter in which a copper alloy soft stock contg. phases such as crystallized products (Cu-1.0 to 4.5 wt.% Ag alloy, 0.2 to 1.5 wt.% Cr alloy, Cu-0.1 to 0.3 wt.% Zr alloy, Cu 0.2 to 1.5 wt.% Cr-0.1 to 0.3 wt.% Zr alloy or 0.3 to 4.0 wt.% Ti alloy) is cold worked and is subjected to process annealing necessary, and in which cold working ratio from the copper alloy soft stock is regulated to $\leq 99.99\%$, the cold working ratio till the following process annealing after the process annealing other than the final process annealing is regulated to $\leq 99.999\%$, and the cold working ratio after the final process annealing is regulated to 80 to 99%.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Date of final disposal of application other than the

examiner's decision of rejection or application

reverted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2000 Japan Patent Office

NOTICES *

The Patent Office is not responsible for any errors caused by the use of this translation.

This document has been translated by computer. So the translation may not reflect the original precisely.
*** shows the word which can not be translated.
In the drawings, any words are not translated.

JMS

im(s)]

im 1] Cold-work the copper alloy elasticity material containing unusual appearances, such as a crystallization object, and give intermediate annealing if needed. When it is the manufacture method of the copper alloy extra fine wire of 50 micrometers or less of wire sizes, the rate of cold working from the aforementioned copper alloy elasticity material is made into 99.999% or less and it gives intermediate annealing. It is the manufacture method of the copper alloy extra fine wire which makes the rate of cold working between intermediate annealing 99.999% or less, and is characterized by making the rate of cold working after the last intermediate annealing 80 - 99%.

im 2] The manufacture method of the copper alloy extra fine wire according to claim 1 characterized by the copper alloy elasticity material containing unusual appearances, such as a crystallization object, being a Cu-1.0-4.5wt%Ag alloy, a Cu-0.2-1.5wt%Cr alloy, a Cu-0.1-0.3wt%Zr alloy, a Cu-0.2-1.5wt%Cr-0.1-0.3wt%Zr alloy, or a Cu-0.3-0.5wt%Ti alloy.

im 3] The manufacture method of the copper alloy extra fine wire according to claim 1 or 2 characterized by giving intermediate annealing for [1 second -] 30 minutes, and giving it at 300-550 degrees C.

translation done.]

* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention is excellent in wire drawing nature, intensity, a defatigation-proof property, etc., and relates to the manufacture method of the copper alloy extra fine wire of 50 micrometers or less of wire sizes suitable for especially the coil.

[0002]

[Description of the Prior Art] Wire drawing nature, intensity, a defatigation-proof property, etc. are required of the copper alloy extra fine wire used for a coil etc. Since especially wire drawing nature influences cost greatly, it is important. The tough pitch copper, the copper alloy containing Sn, the copper alloy containing 0.2% or less of Ag, etc. have been conventionally used for such a copper alloy extra fine wire. And with the miniaturization of a pocket device in recent years, 20 micrometers is asked for thinning from 50 micrometers or less and 30 more micrometers at the extra fine wire for coils, and greater importance is increasingly attached to intensity, a defatigation-proof property, etc. than to before.

[0003]

[Problem(s) to be Solved by the Invention] However, if the conventional copper alloy extra fine wire became a diameter 50 micrometers or less, it will become easy to disconnect it, and the problem has produced it for productivity. Then, by selecting processing conditions, this invention person etc. searched for various copper alloys which are excellent in cold-working nature, and it finds out that thinning can be carried out to a diameter 20 micrometers or less, and a copper alloy, a Cu-Cr alloy, etc. which contain Ag 1% or more advance research further, and came to complete this invention. The purpose of this invention is for the wire size which is excellent in wire drawing nature, intensity, a defatigation-proof property, etc. to offer the manufacture method of a copper alloy extra fine wire 50 micrometers or less.

[0004]

[Means for Solving the Problem] Invention according to claim 1 cold-works the copper alloy elasticity material containing unusual appearances, such as a crystallization object. When it is the manufacture method of the copper alloy extra fine wire of 50 micrometers or less of wire sizes which gives intermediate annealing if needed, the rate of cold working from the aforementioned copper alloy elasticity material is made into 99.999% or less and it gives intermediate annealing. It is the manufacture method of the copper alloy extra fine wire which makes the rate of cold working between intermediate annealing 99.999% or less, and is characterized by making the rate of cold working after the last intermediate annealing 80 - 99%.

[0005] Invention according to claim 2 is the manufacture method of the copper alloy extra fine wire according to claim 1 characterized by the copper alloy elasticity material containing unusual appearances, such as a crystallization object being a Cu-1.0-4.5wt%Ag alloy, a Cu-0.2-1.5wt%Cr alloy, a Cu-0.1-0.3wt%Zr alloy, a Cu-0.2-1.5wt%Cr-0.1-0.3wt%Zr alloy, or a Cu-0.3-4.0wt%Ti alloy.

[0006] Invention according to claim 3 is the manufacture method of the copper alloy extra fine wire according to claim 1 or 2 characterized by holding intermediate annealing for [1 second -] 30 minutes, and giving it at 300-550 degrees C.

[0007]

[Embodiments of the Invention] this invention is the method of cold-working the copper alloy elasticity material containing unusual appearances, such as a crystallization object, by predetermined working ratio, giving intermediate annealing if needed, and processing it into the extra fine wire of 50 micrometers or less of wire sizes. A sludge etc. is contained in unusual appearances, such as the aforementioned crystallization object. As a copper alloy elasticity material, minor diameter ingots, such as a Cu-1.0-4.5wt%Ag alloy, a Cu-0.2-1.5wt%Cr alloy, a Cu-0.1-0.3wt%Zr

, a Cu-0.2-1.5wt%Cr-0.1-0.3wt%Zr alloy, or a Cu-0.3-4.0wt%Ti alloy, hot rolling material (rough drawing wire), extrusion material, an annealed material, etc. are mentioned. The aforementioned copper alloy elasticity material is processed between the colds by rolling, grooved-roll rolling, drawing-out processing, wire drawing, etc., and is processed into the extra fine wire of a request configuration.

[8] Cold working is distributing minutely in the shape of a staple fiber, respectively, and as for these distribution object, in each aforementioned copper alloy, unusual appearances (Ag particle, Cr particle, a Zr-Cu compound particle, Cu compound particle, etc.), such as a crystallization object of an alloy element, achieve the operation which distributes minutely and uniformly the transposition cell formed in a copper alloy matrix in connection with cold working, and raise the cold-working nature of each aforementioned copper alloy to it. Since there are few aforementioned crystallization objects etc. under at a minimum, when no reasons for a convention of the amount of elements of each aforementioned copper alloy are distributed minutely [a transposition cell] and uniformly but exceed an upper limit, a crystallization object etc. is for turning and causing an open circuit big and rough remarkably. [9] the aforementioned crystallization object is detailed in a transposition cell as mentioned above -- and although it utilizes, on the other hand, if cold working progresses, a transposition cell will turn minutely remarkably, pinning of transposition is carried out there, and an open circuit becomes easy to occur

[10] Then, in this invention, when the rate of cold working from the aforementioned copper alloy elasticity material exceeds 99.999%, intermediate annealing is given and an open circuit is prevented. By intermediate annealing, transposition moves in heat activity, a transposition cell turns big and rough, and cold-working nature is improved. The rate of cold working between intermediate annealing in the case of giving intermediate annealing two or more times is more than 99.999% or less like the rate of cold working from the aforementioned copper alloy elasticity material. However, the rate of cold working after the last intermediate annealing is specified to 80 - 99%. When the intensity which needs a reason for a copper alloy extra fine wire at less than 80% is not obtained but it exceeds 99%, a transposition cell is turning and becoming easy to disconnect in the cases, such as coiling, minutely. In addition, a Cu-Cr alloy, a Cu-Zr alloy, and a Cu-Ti alloy can raise intensity further by giving an aging treatment after cold working.

[11] As mentioned above, if a transposition cell carries out intermediate annealing of the cold-working wire rod turned minutely, transposition will move in heat activity, a transposition cell will turn big and rough, and cold-working nature will be improved. When, as for the aforementioned intermediate annealing, the effect exceeds 550 degrees C by not obtaining an annealing temperature at less than 300 degrees C, the on-the-strength fall by annealing is large, henceforth, even if it cold-works, sufficient intensity is no longer obtained. Moreover, if the time for annealing is moving in [transposition] heat activity in less than 1 second runs short and it exceeds 30 minutes, the effect of intermediate annealing will be saturated and it will become disadvantageous in energy cost. Therefore, as for intermediate annealing, it is desirable to give for [1 second -] 30 minutes at 300-550 degrees C.

[12] [Example] An example explains this invention in detail below.

[Example 1] The horizontal-type continuous casting machine cast the various copper alloys of the composition in this invention convention to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled in the diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and it considered as the wire rod of the diameter of 0.30mm, or the diameter of 0.05mm. Subsequently, annealing between ** was given to each aforementioned wire rod on the conditions held for 30 seconds at 300-550 degrees C, wire drawing was again carried out to it after that, and the copper alloy extra fine wire of the diameter of 20 micrometer (0.02mm) was manufactured.

[13] (Example 2) The horizontal-type continuous casting machine cast the various copper alloys of the composition in this invention convention to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled in the diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and it considered as the wire rod of the diameter of 0.30mm, or the diameter of 0.05mm. Subsequently, annealing between ** was given to each aforementioned wire rod on the conditions held for 30 seconds at 580 degrees C or 280 degrees C, wire drawing was again carried out to it after that, and the copper alloy extra fine wire of the diameter of 20 micrometer was manufactured.

[14] (Example 1 of comparison) The horizontal-type continuous casting machine cast the various copper alloys of the composition in this invention convention to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled in the diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and it considered as the wire rod of the diameter of 0.30mm, or the diameter of 0.03mm. Subsequently, annealing between ** was given to each aforementioned wire rod on the conditions held for 30 seconds at 400 degrees C, wire drawing was again carried out to it after that, and the copper alloy extra fine wire of the diameter of 20 micrometer was manufactured.

[15] (Example 2 of comparison) The horizontal-type continuous casting machine cast the various copper alloys of the composition in this invention convention to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled in the diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and the copper alloy extra fine

of the diameter of 20 micrometer was manufactured. Annealing between ** was not given the middle.

5] (Example 3 of comparison) The horizontal-type continuous casting machine cast the copper alloy of position this invention convention outside to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled a diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and it considered as the wire rod e diameter of 0.10mm, or the diameter of 0.05mm. Subsequently, annealing between ** was given to each mentioned wire rod on the conditions held for 30 seconds at 400 degrees C, wire drawing was again carried out to er that, and the copper alloy extra fine wire of the diameter of 20 micrometer was manufactured.

7] Tensile strength, a defatigation fracture property, and wire drawing nature were investigated about each copper extra fine wire obtained in examples 1 and 2 and the examples 1-3 of comparison. A defatigation fracture erty is 2 200Ns/mm. It expressed with the number of times to the fracture when repeating bending 90 degrees, ing out the load of the stress. One round trip was counted with 1 time. Wire drawing nature was expressed with alue which **(ed) the amount of wire drawings by the number of times of fracture when carrying out a nuation wire drawing to 20 micrometers from 30 micrometers. The analysis value of alloy composition is shown ble 1, and results of an investigation are shown in Tables 2-5, respectively. A drawing condition and annealing itions were written together in Tables 2-5.

8]

le 1]

合金	A g	C r	Z r	T i		合金	A g	C r	Z r	T i
1	1.0	---	---	---	本 発 明 規 定 外 組 成 合 金	1 0	0.2	---	---	---
2	2.0	---	---	---		1 1	---	0.15	---	---
3	4.0	---	---	---		1 2	---	---	0.05	---
4	---	0.3	---	---		1 3	---	0.04	0.03	---
5	---	1.3	---	---		1 4	---	---	---	0.1
6	---	---	0.25	-						
7	---	0.28	0.22	---						
8	---	---	---	0.5						
9	---	---	---	3.8						

(注) 単位wt%。

19]

ole 2]

試料	合金	焼鈍サイズ # mm	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1断線
1	1	0.1	400	840	17	3.9
2		0.05	400	800	10	4.1
3	2	0.1	550	880	23	3.5
4		0.1	400	950	40	3.8
5		0.1	300	970	42	3.6
6		0.05	400	900	35	4.2
7	3	0.1	400	1010	45	3.6
8		0.05	400	960	41	3.4
9	4	0.1	400	890	24	3.5
10		0.05	400	850	18	4.0
11	5	0.1	400	960	41	3.5
12		0.05	400	920	37	3.7

e) Diameter of diameter-(96%) -> of diameter-(99.99%)--> of #10mm 0.1mm 0.02mm Diameter of diameter [of
eter / of 10mm /-(99.9975%) ->0.05mm]-(84%) ->0.02mm Sample No.1-12 are an example 1.

0]

le 3]

試料	合金	焼鈍線径 # mm	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1断線
13	6	0.1	400	850	15	3.8
14		0.05	400	800	10	4.1
15	7	0.1	400	940	35	3.5
16		0.05	400	900	28	3.8
17	8	0.1	400	1100	50	3.1
18		0.05	400	1050	44	3.3
19	9	0.1	400	1210	57	3.0
20		0.05	400	1140	53	3.1
21	2	0.1	570	840	14	3.7
22		0.1	280	990	43	3.4
23	3	0.1	570	910	29	3.6
24		0.1	280	1060	45	3.3

te) Diameter of #10mm -- (99.99%) Diameter of -> 0.1mm (96%) Diameter of ->0.02mm Diameter of diameter [of

n]-(99.9975%) ->0.05mm (84%) Diameter of ->0.02mm Sample No.13-20 are an example 1 and sample No.21-
e an example 2.

1]
le 4]

試料	合金	焼鈍線径 # mm	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1 断線
25	2	0.3	400	980	33	1.3
26		0.03	400	720	2.1	2.8
27	3	0.3	400	1010	38	1.5
28		0.03	400	760	3.3	2.6
29	4	0.3	400	910	18	1.1
30		0.03	400	680	1.1	2.2
31	6	0.3	400	870	15	0.8
32		0.03	400	620	0.9	1.4
33	7	0.3	400	960	28	0.7
34		0.03	400	730	1.8	1.6
35	8	0.3	400	1070	39	1.9
36		0.03	400	790	3.8	2.7

e) Diameter of diameter-(99.56%) ->of diameter-(99.91%)--> of #10mm 0.3mm 0.02mm Diameter of diameter
diameter / of 10mm /-(99.9991%) ->0.03mm]-(55.56%) ->0.02mm. [0022]
le 5]

分類	試料	合金	焼鈍材ズ # mm 径	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1 断線
比較 例 2	37	2	中間焼鈍なし		1 0 5 0	3 4	0. 3 4
	38	3	"		1 0 6 0	3 6	0. 4 1
	39	4	"		8 2 0	1 6	0. 2 2
	40	6	"		8 2 0	1 4	0. 3 2
	41	7	"		8 4 0	1 8	0. 5 0
	42	8	"		1 0 1 0	3 3	0. 3 7
比較 例 3	43	10	0. 1	4 0 0	9 2 0	1 9	0. 3 3
	44		0. 0 5	4 0 0	8 7 0	1 4	0. 5 2
	45	11	0. 1	4 0 0	6 5 0	1. 0	2. 8 3
	46		0. 0 5	4 0 0	6 2 0	0. 8	2. 5 2
	47	12	0. 1	4 0 0	7 2 0	3. 5	1. 4
	48		0. 0 5	4 0 0	6 2 0	1. 1	1. 6
	49	13	0. 1	4 0 0	8 1 0	9. 5	1. 7
	50		0. 0 5	4 0 0	7 8 0	3. 3	1. 2
	51	14	0. 1	4 0 0	9 5 0	1 8	0. 5 2
	52		0. 0 5	4 0 0	9 2 0	2 1	0. 4 4

(Note) Diameter of #10mm -(99.9996%)----- Diameter of >0.02mm (with no intermediate annealing)
Diameter of 10mm -- (99.99%) Diameter of > 0.1mm (96%) Diameter of >0.02mm Diameter of diameter [of
10mm]-(99.9975%) >0.05mm (84%) Diameter of >0.02mm. [0023] In having wire drawing nature 3.0kg [per one
open circuit] or more, each sample No.1-24 of the example of this invention is excellent also in intensity and the
defatigation-proof property, so that more clearly than Tables 2-5 (two or more [800Ns //mm] tensile strength and th
number of times of defatigation fracture more than 107 times). On the other hand, example 1 of comparison No.25-3
and example 2 of comparison Since the rate of cold working separated from the convention of this invention, No.37-
are the example 3 of comparison. Since No.43-52 had few amounts of alloy elements, they were that to which wire
drawing nature falls and neither is suitable for practical use. Moreover, thing to which the rate of cold working after
last intermediate annealing exceeded 99% (No.25, 27, 29, 31, 33, 35) The waist is weakly inferior to coiling nature (i
does not display), and the aforementioned rate of cold working is less than 80% of thing (No.26, 28, 30, 32, 34, 36).
was inferior to tensile strength and the defatigation fracture property. No.45-50 were inferior in at least one sort of
tensile strength and a defatigation fracture property among those for which the amount of alloy elements was
insufficient.

[0024]

[Effect of the Invention] As stated above, moreover, by this invention, since the crystallization object contained there
distributes a transposition cell minutely and uniformly, the copper alloy used by this invention is excellent in cold-
working nature, and it is predetermined conditions about the aforementioned copper alloy, and since it cold-works
putting in annealing if needed, it can manufacture an extra fine wire 50 micrometers or less good. The extra fine wire
furthermore obtained in this invention is excellent also in intensity and a defatigation-proof property. Therefore, this
invention is applied to manufacture of a coil etc. and does a remarkable effect so.

[Translation done.]

TICES *

n Patent Office is not responsible for any
ges caused by the use of this translation.

is document has been translated by computer. So the translation may not reflect the original precisely.
** shows the word which can not be translated.
he drawings, any words are not translated.

HNICAL FIELD

technical field to which invention belongs] this invention is excellent in wire drawing nature, intensity, a fatigue-
f property, etc., and relates to the manufacture method of the copper alloy extra fine wire of 50 micrometers or less
ire sizes suitable for especially the coil.

aslation done.]

NOTICES *

The Patent Office is not responsible for any damages caused by the use of this translation.

This document has been translated by computer. So the translation may not reflect the original precisely.

*** shows the word which can not be translated.

In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] Wire drawing nature, intensity, a fatigue-proof property, etc. are required of the copper by extra fine wire used for a coil etc. Since especially wire drawing nature influences cost greatly, it is important. As tough pitch copper, the copper alloy containing Sn, the copper alloy containing 0.2% or less of Ag, etc. have been conventionally used for such a copper alloy extra fine wire. And with the miniaturization of a pocket device in recent years, 20 micrometers is asked for thinning from 50 micrometers or less and 30 more micrometers at the extra fine wire coils, and greater importance is increasingly attached to intensity, a fatigue-proof property, etc. than to before.

[Translation done.]

TICES *

n Patent Office is not responsible for any
ges caused by the use of this translation.

is document has been translated by computer. So the translation may not reflect the original precisely.

** shows the word which can not be translated.

he drawings, any words are not translated.

EFFECT OF THE INVENTION

ect of the Invention] As stated above, moreover, by this invention, since the crystallization object contained there
butes a transposition cell minutely and uniformly, the copper alloy used by this invention is excellent in cold-
ing nature, and it is predetermined conditions about the aforementioned copper alloy, and since it cold-works
ng in annealing if needed, it can manufacture an extra fine wire 50 micrometers or less good. The extra fine wire
ermore obtained in this invention is excellent also in intensity and a defatigation-proof property. Therefore, this
ation is applied to manufacture of a coil etc. and does a remarkable effect so.

nslation done.]

NOTICES *

The Patent Office is not responsible for any damages caused by the use of this translation.

This document has been translated by computer. So the translation may not reflect the original precisely.

*** shows the word which can not be translated.

In the drawings, any words are not translated.

TECHNICAL PROBLEM

blem(s) to be Solved by the Invention] However, if the conventional copper alloy extra fine wire became a diameter 50 micrometers or less, it will become easy to disconnect it, and the problem has produced it for productivity. In, by selecting processing conditions, this invention person etc. searched for various copper alloys which are excellent in cold-working nature, and it finds out that thinning can be carried out to a diameter 20 micrometers or less, a copper alloy, a Cu-Cr alloy, etc. which contain Ag 1% or more advance research further, and came to complete invention. The purpose of this invention is for the wire size which is excellent in wire drawing nature, intensity, a break-proof property, etc. to offer the manufacture method of a copper alloy extra fine wire 50 micrometers or less.

translation done.]

NOTICES *

The Patent Office is not responsible for any damages caused by the use of this translation.

This document has been translated by computer. So the translation may not reflect the original precisely.

*** shows the word which can not be translated.

In the drawings, any words are not translated.

ANS

[Means for Solving the Problem] Invention according to claim 1 cold-works the copper alloy elasticity material containing unusual appearances, such as a crystallization object. When it is the manufacture method of the copper alloy extra fine wire of 50 micrometers or less of wire sizes which gives intermediate annealing if needed, the rate of cold working from the aforementioned copper alloy elasticity material is made into 99.999% or less and it gives intermediate annealing. It is the manufacture method of the copper alloy extra fine wire which makes the rate of cold working between intermediate annealing 99.999% or less, and is characterized by making the rate of cold working after last intermediate annealing 80 - 99%.

[05] Invention according to claim 2 is the manufacture method of the copper alloy extra fine wire according to claim 1 characterized by the copper alloy elasticity material containing unusual appearances, such as a crystallization object, being a Cu-1.0-4.5wt%Ag alloy, a Cu-0.2-1.5wt%Cr alloy, a Cu-0.1-0.3wt%Zr alloy, a Cu-0.2-1.5wt%Cr-0.1-0.3wt%Zr alloy, or a Cu-0.3-4.0wt%Ti alloy.

[06] Invention according to claim 3 is the manufacture method of the copper alloy extra fine wire according to claim 1 characterized by holding intermediate annealing for [1 second -] 30 minutes, and giving it at 300-550 degrees

[07]

[Embodiments of the Invention] this invention is the method of cold-working the copper alloy elasticity material containing unusual appearances, such as a crystallization object, by predetermined working ratio, giving intermediate annealing if needed, and processing it into the extra fine wire of 50 micrometers or less of wire sizes. A sludge etc. is contained in unusual appearances, such as the aforementioned crystallization object. As a copper alloy elasticity material, minor diameter ingots, such as a Cu-1.0-4.5wt%Ag alloy, a Cu-0.2-1.5wt%Cr alloy, a Cu-0.1-0.3wt%Zr alloy, a Cu-0.2-1.5wt%Cr-0.1-0.3wt%Zr alloy, or a Cu-0.3-4.0wt%Ti alloy, hot rolling material (rough drawing wire), extrusion material, an annealed material, etc. are mentioned. The aforementioned copper alloy elasticity material is processed between the colds by rolling, grooved-roll rolling, drawing-out processing, wire drawing, etc., and is processed into the extra fine wire of a request configuration.

[08] Cold working is distributing minutely in the shape of a staple fiber, respectively, and as for these distribution object, in each aforementioned copper alloy, unusual appearances (Ag particle, Cr particle, a Zr-Cu compound particle, Cu compound particle, etc.), such as a crystallization object of an alloy element, achieve the operation which distributes minutely and uniformly the dislocation cell formed in a copper alloy matrix in connection with cold working, and raise the cold-working nature of each aforementioned copper alloy to it. Since there are few aforementioned crystallization objects etc. under at a minimum, when no reasons for a convention of the amount of alloy elements of each aforementioned copper alloy are distributed minutely [a dislocation cell] and uniformly but exceed an upper limit, a crystallization object etc. is for turning and causing an open circuit big and rough remarkably.

[09] the aforementioned crystallization object is detailed in a dislocation cell as mentioned above -- and although it stabilizes, on the other hand, if cold working progresses, a dislocation cell will turn minutely remarkably, pinning of dislocation is carried out there, and an open circuit becomes easy to occur

[10] Then, in this invention, when the rate of cold working from the aforementioned copper alloy elasticity material exceeds 99.999%, intermediate annealing is given and an open circuit is prevented. By intermediate annealing, dislocation moves in heat activity, a dislocation cell turns big and rough, and cold-working nature is improved. The rate of cold working between intermediate annealing in the case of giving intermediate annealing two or more times is made 99.999% or less like the rate of cold working from the aforementioned copper alloy elasticity material. However, the rate of cold working after the last intermediate annealing is specified to 80 - 99%. When the intensity which needs the reason for a copper alloy extra fine wire at less than 80% is not obtained but it exceeds 99%, a dislocation cell is for turning and becoming easy to disconnect in the cases, such as coiling, minutely. In addition, a Cu-Cr alloy, a Cu-Zr

NOTICES *

The Patent Office is not responsible for any damages caused by the use of this translation.

This document has been translated by computer. So the translation may not reflect the original precisely.

*** shows the word which can not be translated.

In the drawings, any words are not translated.

EXAMPLE

[Example] An example explains this invention in detail below.

[Example 1] The horizontal-type continuous casting machine cast the various copper alloys of the composition in this invention convention to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled in the diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and it considered as the wire rod of the diameter of 0.30mm, or the diameter of 0.05mm. Subsequently, annealing between ** was given to each aforementioned wire rod on the conditions held for 30 seconds at 300-550 degrees C, wire drawing was again carried out to it after that, and the copper alloy extra fine wire of the diameter of 20 micrometer (0.02mm) was manufactured.

[13] (Example 2) The horizontal-type continuous casting machine cast the various copper alloys of the composition in this invention convention to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled in the diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and it considered as the wire rod of the diameter of 0.30mm, or the diameter of 0.05mm. Subsequently, annealing between ** was given to each aforementioned wire rod on the conditions held for 30 seconds at 580 degrees C or 280 degrees C, wire drawing was again carried out to it after that, and the copper alloy extra fine wire of the diameter of 20 micrometer was manufactured.

[14] (Example 1 of comparison) The horizontal-type continuous casting machine cast the various copper alloys of the composition in this invention convention to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled in the diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and it considered as the wire rod of the diameter of 0.30mm, or the diameter of 0.03mm. Subsequently, annealing between ** was given to each aforementioned wire rod on the conditions held for 30 seconds at 400 degrees C, wire drawing was again carried out to it after that, and the copper alloy extra fine wire of the diameter of 20 micrometer was manufactured.

[15] (Example 2 of comparison) The horizontal-type continuous casting machine cast the various copper alloys of the composition in this invention convention to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled in the diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and the copper alloy extra fine wire of the diameter of 20 micrometer was manufactured. Annealing between ** was not given the middle.

[16] (Example 3 of comparison) The horizontal-type continuous casting machine cast the copper alloy of the composition in this invention convention outside to the cylindrical ingot of the diameter of 10.8mm, this ingot was peeled in the diameter of 10mm, wire drawing of the ingot after this peeling was carried out, and it considered as the wire rod of the diameter of 0.10mm, or the diameter of 0.05mm. Subsequently, annealing between ** was given to each aforementioned wire rod on the conditions held for 30 seconds at 400 degrees C, wire drawing was again carried out to it after that, and the copper alloy extra fine wire of the diameter of 20 micrometer was manufactured.

[17] Tensile strength, a fatigue fracture property, and wire drawing nature were investigated about each copper alloy extra fine wire obtained in examples 1 and 2 and the examples 1-3 of comparison. A fatigue fracture property is 200000N/mm. It expressed with the number of times to the fracture when repeating bending 90 degrees, carrying out the load of the stress. One round trip was counted with 1 time. Wire drawing nature was expressed with the value which ** is the amount of wire drawings by the number of times of fracture when carrying out a continuation wire drawing to 20 micrometers from 30 micrometers. The analysis value of alloy composition is shown in Table 1, and results of an investigation are shown in Tables 2-5, respectively. A drawing condition and annealing conditions were written together in Tables 2-5.

[18]

Table 1]

合金	Ag	Cr	Zr	Ti		合金	Ag	Cr	Zr	Ti
1	1.0	---	---	---	本 発 明 規 定 外 組 成 合 金	10	0.2	---	---	---
2	2.0	---	---	---		11	---	0.15	---	---
3	4.0	---	---	---		12	---	---	0.05	---
4	---	0.3	---	---		13	---	0.04	0.03	---
5	---	1.3	---	---		14	---	---	---	0.1
6	---	---	0.25	---						
7	---	0.28	0.22	---						
8	---	---	---	0.5						
9	---	---	---	3.8						

(注) 単位wt%。

9]
le 2]

試料	合金	焼鈍材ズ # mm	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1断線
1	1	0.1	400	840	17	3.9
2		0.05	400	800	10	4.1
3	2	0.1	550	880	23	3.5
4		0.1	400	950	40	3.8
5		0.1	300	970	42	3.6
6		0.05	400	900	35	4.2
7	3	0.1	400	1010	45	3.6
8		0.05	400	960	41	3.4
9	4	0.1	400	890	24	3.5
10		0.05	400	850	18	4.0
11	5	0.1	400	960	41	3.5
12		0.05	400	920	37	3.7

te) Diameter of diameter-(96%) -> of diameter-(99.99%)--> of #10mm 0.1mm 0.02mm Diameter of diameter [of
meter / of 10mm /-(99.9975%) ->0.05mm]-(84%) ->0.02mm Sample No.1-12 are an example 1.
20]
ble 3]

試料	合金	焼鈍線径 # mm	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1断線
13	6	0.1	400	850	15	3.8
14		0.05	400	800	10	4.1
15	7	0.1	400	940	35	3.5
16		0.05	400	900	28	3.8
17	8	0.1	400	1100	50	3.1
18		0.05	400	1050	44	3.3
19	9	0.1	400	1210	57	3.0
20		0.05	400	1140	53	3.1
21	2	0.1	570	840	14	3.7
22		0.1	280	990	43	3.4
23	3	0.1	570	910	29	3.6
24		0.1	280	1060	45	3.3

te) Diameter of #10mm -- (99.99%) Diameter of -> 0.1mm (96%) Diameter of ->0.02mm Diameter of diameter [of
 1m]-(99.9975%) ->0.05mm (84%) Diameter of ->0.02mm Sample No.13-20 are an example 1 and sample No.21-
 are an example 2.

21]

ble 4]

試料	合金	焼鈍線径 # mm	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1断線
25	2	0.3	400	980	33	1.3
26		0.03	400	720	2.1	2.8
27	3	0.3	400	1010	38	1.5
28		0.03	400	760	3.3	2.6
29	4	0.3	400	910	18	1.1
30		0.03	400	680	1.1	2.2
31	6	0.3	400	870	15	0.8
32		0.03	400	620	0.9	1.4
33	7	0.3	400	960	28	0.7
34		0.03	400	730	1.8	1.6
35	8	0.3	400	1070	39	1.9
36		0.03	400	790	3.8	2.7

(Note) Diameter of diameter-(99.56%) -> of diameter-(99.91%)--> of #10mm 0.3mm 0.02mm Diameter of diameter
[of diameter / of 10mm /-(99.9991%) ->0.03mm]-(55.56%) ->0.02mm. [0022]
[Table 5]

分類	試料	合金	焼鈍サイズ # mm 径	焼鈍温度 ℃	引張強さ N/mm ²	疲労破断 回数×10 ⁶	伸線性 kg/1 断線
比較 例 2	37	2	中間焼鈍なし		1050	34	0.34
	38	3	"		1060	36	0.41
	39	4	"		820	16	0.22
	40	6	"		820	14	0.32
	41	7	"		840	18	0.50
	42	8	"		1010	33	0.37
比較 例 3	43	10	0.1	400	920	19	0.33
	44		0.05	400	870	14	0.52
	45	11	0.1	400	650	1.0	2.83
	46		0.05	400	620	0.8	2.52
	47	12	0.1	400	720	3.5	1.4
	48		0.05	400	620	1.1	1.6
	49	13	0.1	400	810	9.5	1.7
	50		0.05	400	780	3.3	1.2
	51	14	0.1	400	950	18	0.52
	52		0.05	400	920	21	0.44

(Note) Diameter of #10mm -(99.9996%)----- Diameter of ->0.02mm (with no intermediate annealing)
Diameter of 10mm -- (99.99%) Diameter of -> 0.1mm (96%) Diameter of ->0.02mm Diameter of diameter [of
10mm]-(99.9975%) ->0.05mm (84%) Diameter of ->0.02mm. [0023] In having wire drawing nature 3.0kg [per on
open circuit] or more, each sample No.1-24 of the example of this invention is excellent also in intensity and the
fatigue-proof property, so that more clearly than Tables 2-5 (two or more [800Ns //mm] tensile strength and the
number of times of fatigue fracture more than 107 times). On the other hand, example 1 of comparison No.25-36 an
example 2 of comparison Since the rate of cold working separated from the convention of this invention, No.37-42.
the example 3 of comparison. Since No.43-52 had few amounts of alloy elements, they were that to which wire
drawing nature falls and neither is suitable for practical use. Moreover, thing to which the rate of cold working after
last intermediate annealing exceeded 99% (No.25, 27, 29, 31, 33, 35) The waist is weakly inferior to coiling nature
does not display), and the aforementioned rate of cold working is less than 80% of thing (No.26, 28, 30, 32, 34, 36)
was inferior to tensile strength and the fatigue fracture property. No.45-50 were inferior in at least one sort of tensil
strength and a fatigue fracture property among those for which the amount of alloy elements was insufficient.

[Translation done.]